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THE FOOD OF PORTO RICAN LIZARDS

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Of the factors which most vitally affect the abundance of injurious insects are the organisms which destroy them. Insects suffer enormous losses due to diseases caused by fungi and bacteria and "The Entomogenous Fungi of Porto Rico" (1) were among the first subjects investigated at the Insular Experiment Station. The insects which are parasitic or predaceous on injurious insects have been studied and reported, usually in publications dealing with the specific injurious insect, altho in one instance, "El Cucubano," (2) the beneficial insect itself is discussed. The food of the "Birds of Porto Rico" (3) was studied by Mr. Alex Wetmore and the results published in an extensive paper that is a mine of useful information. But of the two publications dealing with the food of lizards, one (4) is based largely on field observations, and partly on suppositions and deductions which in some cases prove to be erroneous, the other (5) is written from the standpoint of the herpetologist and the identifications of the insects are generalized and in only one case even generic. It is the purpose of the present paper to discuss the food of lizards from the standpoint of the economic entomologist, or in a broader sense, of the agriculturist, basing the discussion on a rather considerable number of examinations of the stomach contents of the commoner species of lizards, and, so far as possible, on the specific identification of the insects there found.

As to which of these factors—the fungi and bacteria, the predaceous and parasitic insects, the birds or the lizards—has the greater influence on the destructive insects, little can be said in general terms. The fungi are possibly of greatest importance in the citrus groves, where several species attack the scale insects, and under favorable conditions of humidity, may so far control them that the scales cease to be pests that need to be artificially destroyed. Other kinds of fungi attack white grubs, and the caterpillars of the moth stalk borer of sugar cane, but the climatic and other con-

ditions necessary for their development are so seldom realized that practically they are of little value.

The larva of the cucubano, *Pyrophorus luminosus* Illiger, is a most important ally of the agriculturist because of the large number of white grubs and other soil-inhabiting insects which it eats. No other predaceous insect even approaches it in value in destroying white grubs, but unfortunately, its benefits, as well as those of the Tachinid fly parasites, *Cryptomeigenia aurifacies* Walton and *Eutrixoides jonesii* Walton, of the adult beetles, are largely confined to the moister parts of the Island. The *cucubano* larva attacks other soil- and root-inhabiting grubs; it has been found in the tunnel of the moth borer in the butt of a stalk of sugar cane, where it had destroyed the caterpillar; and, in captivity, it has even attacked the *changa*. No insect parasites of the *changa*, or of such destructive beetles as the common weevil root-borer or "vaquita," *Diaprepes spengleri* Linn., or the banana root-borer, *Cosmopolites sordidus* Germar, have been found, and possibly this may in part explain their destructiveness.

The ubiquitous and minute egg parasite, *Trichogramma minutum* Riley, attacks the eggs of many moths and butterflies, and is possibly of greatest importance as a parasite of the moth stalk-borer of sugar cane, *Diatraea saccharalis* Fabr., because this caterpillar is so seldom parasitized or destroyed by other means. Some of the other destructive caterpillars, such as the common cane caterpillar or grassworm, *Laphygma frugiperda* S. & A., the cane looper, *Mocis repanda* Fabr., and the cotton caterpillar, *Alabama argillacea* Hübner, have a host of Tachinid and Hymenopterous parasites, but due to the unstable equilibrium between host and parasites, these pests sometimes occur in enormous abundance and do much damage before their parasites become sufficiently abundant to eliminate them. Other caterpillars, especially those feeding on tobacco, are rather rarely parasitized, and for the control of these, artificial methods must often be adopted.

Birds are a most important factor in the destruction of insects. The comparatively large size of the individual bird, its high body temperature and the active life which it leads require that it consume an enormous amount of food. Translated into terms of insects, to quote from Wetmore: "One stomach (of the blackbird or *mozambique*) contained 16 cutworms, as well as 3 adult cane root-boring weevils, *Diaprepes spengleri* Linn." "Remains of 11 (of these weevils) were taken from the gizzard and from 3 to 6 were

not unusual." "Two birds had eaten cattle ticks, *Margaropus annulatus* . . . one, ... 35 ticks, the other 12 ticks, all greatly distended with blood." And these figures represent only one meal of the blackbird, not all the food that one bird eats during one day.

But as effective as some insectivorous birds may be in destroying insects, in Porto Rico their influence is minimized by their comparative rarity, especially in comparison with the number of lizards occupying the same area. To be sure, the lizards average smaller than the birds, but what the individual lizard lacks in size is much more than counterbalanced by their enormous numbers. Laboratory experiments with lizards to determine how much they eat, for comparison with how much birds eat, have not been very successful, and because lizards are not warm-blooded, nor as active as birds, they presumably eat considerably less than do birds of comparable size. But their extraordinary abundance makes them one of the major factors in reducing the numbers of insects.

The only way of determining with certainty the food of a wild animal is by dissection and examination of the stomach contents. In making such determinations, certain points should be observed. (1) The animals collected should be obtained at an appropriate time of day so that one may be reasonably sure that they have fed recently. (2) A sufficient number should, if possible, be examined to give a fair average, and largely minimize some abnormal element of food which might otherwise be given undue prominence. (3) In temperate countries, where there is a sharply defined seasonal succession of foods available for many animals, the examinations should be made at all seasons of the year. In Porto Rico, only a few insects have even well-defined periods of seasonal abundance, and the resulting variations in what the lizards eat are consequently quite minor. (4) The variations due to the various environments under which individuals of the same species of lizard may live may exert a much greater effect, and this proved to be the case in the present investigation. About half of the lizards were collected at Río Piedras but under as widely varying conditions of environment as possible, and the remainder from other parts of the Island. The composite data thus obtained, will, it is hoped, at least in the case of the commoner and consequently more important species, present an accurate picture of what the lizards eat.

To properly value the benefits of the agricultural interests of the Island derived from the insectivorous habits of the lizards, a specific identification of the elements of their food is often most

essential. Anything less than this may prove valueless from the standpoint of the agriculturist, because the vital point is whether the insect eaten is beneficial or injurious. However, the classification into beneficial, neutral and injurious forms is by no means so simple as might at first appear.

For instance: the kingbird in the United States has the reputation of being a serious enemy of honey bees, but when a careful examination was made of the bees that these birds had eaten, it was found that most of them were drones and only a very few were workers.

In Porto Rico the cane caterpillar and grassworm, *Laphygma frugiperda* S. & A., feeds on the leaves of sugar cane and grasses, and is very destructive in cane fields and low pastures, but it also eats grasses which are weeds in cane fields and those of other cultivated crops, and it is to this exent beneficial. The caterpillar of *Xylomiges eridania* Cramer feeds on "bledo" or *Amaranthus* spp. and wild eggplant, both common weeds, but it is just as likely to feed on the leaves of cultivated eggplant or tomatoes, and be a serious pest. The little Chrysomelid beetle, *Chaetocnema apricaria* Suffrian, feeds on the leaves of sweet-potato, and if one found specimens in the stomach of a lizard collected in a sweet-potato patch, there would be no question about stating that the lizard was beneficial to the extent of having destroyed an injurious beetle. But the beetle also feeds not only on the leaves of the mangrove and other lagoon-margin trees, but also on the leaves of the wild morning glory, which is a most persistent weed.

In the following discussion, the insects which may be, and for the most part are injurious, are grouped with those which are invariably injurious. Also, because in many cases, the caterpillars could not be specifically identified (altho often to genus and almost always to family) they are listed as injurious, even tho it is realized that they may be beneficial. Considered from another point of view, however, this is not entirely unjustifiable. It is even an underestimate of the number of caterpillars which the lizard might eat if there were a destructive outbreak of some injurious species. And this is not merely a suposition. The caterpillars of *Mocis repanda* Fabr., the cane and grass looper, were very abundant generally in Porto Rico during the late fall and early winter of 1923, and were so abundant in many restricted areas as to entirely destroy the cane or grass growing there. One cane grower claimed they were so abundant in a field near his house that he could hear

the noise of their jaws at night. In the months before and after the exceptional abundance of *Mocis repanda,* a rather small percentage of many other different kinds of caterpillars was found in the stomachs of the lizards examined, but during the months of the abundance of *Mocis repanda,* the percentage of caterpillars eaten more than double and practically all were of this one injurious species.

Because lizards (and birds) do, within limits, vary their diet depending upon what food is to be had, thus making their services in checking an outbreak of a destructive insect more immediately available, their value is correspondingly greater than that of parasitic insects, which are usually much more restricted as to their host. Even if under ordinary circumstances a considerable portion of the food of lizards consists of insects neutral in their relation to man, or even those that on occasion are positively beneficial, these insects can well be spared. They serve to maintain a much larger force of lizards available for immediate use in checking the outbreak of destructive insects than could otherwise exist were they forced to depend entirely on injurious insects for their food.

To partly offset this admittedly artificial grouping of all caterpillars as injurious, is the placing of all predaceous and parasitic insects as beneficial. Not all are, or rather, not all are all of the time, altho most are much of the time. They are beneficial to the extent that they prey upon destructive insects, and injurious to the extent that they destroy beneficial insects. But one can never hope to accurately determine these proportions. And as the lizards eat the injurious insects themselves in so much **larger** quantities than they do the parasitic and predaceous insects and spiders, the relatively small element in their food of possibly beneficial insects should not be too harshly judged.

Nineteen species of lizards have been listed as occurring in Porto Rico (6) but some are quite rare and are correspondingly unimportant economically. When individuals of any of the rarer species have been collected, the observations made on their food are here recorded, but this is quite incidental to the main investigation on the food of the commoner species.

To Mr. Francisco Seín, Jr., Assistant in the Department of Entomology, I am much indebted for aid in the collection of material, as practically all of the lizards of the genus Anolis were caught by him. The peon assistant in the laboratory, Andrés To-

rres y Ríos, caught most of the *Ameiva*. For killing the lizards, carbon bisulfid was found most satisfactory in rapidity of action, and was administered in a large bottle with cotton in the bottom. Dissections were usually made immediately, altho sometimes postponed till the following day, but the contents of the stomachs were often placed in alcohol for later examination.

The largest common lizard *Ameiva exsul* Cope in Porto Rico is the "iguana" or ground lizard. It is most often noted running swiftly along the ground near the coast or in river valleys, but sometimes occurs in hills of no great elevation. Around Río Piedras it is quite common, but runs so rapidly and remains in its burrow for such a large part of the day that specimens are captured with difficulty.

Two batches of eggs, four in one and seven in another, were found buried at a depth of four or five inches in a pile of humus in the garden at the Station. Four that were not broken measured:

22 mm. × 15.5 mm.—faintly pink in color
21 mm. × 13 mm.
20.5 mm. × 13.5 mm. } bright pink in color
20 mm. × 13 mm.

From one egg a lizard hatched and was kept for a considerable time in captivity. During the first few days he ate no food, but drank large amounts of water. Later, he daily ate one quite large insect about noon. He lived quite happily in a tobacco can horizontally buried in the soil, and would often cover the entrance to his burrow with earth while he was inside. Ordinarily he did not appear above ground till 11 a. m., or later, often retreating to his burrow several times before eating, and always retiring soon after his meal, not to appear again till the next midday. Later, as he grew older, and especially if his container were placed in the sunlight, he might appear above ground earlier in the day, sometimes by 9 a. m. or 8:30. He was fed large cockroach nymphs, 2nd- and 3rd-instar white grubs, *Lachnosterna portoricensis* Smyth, silkworm caterpillars and moths, and half-grown tobacco hornworm caterpillars, *Protoparce sexta* Joh.

The normal habits of the *iguana* do not differ greatly from the one kept in captivity, except that ordinarily the entrances to their tunnels are not filled with earth. Obtaining food only during the middle of the day is undoubtedly characteristic of this species, as the stomachs of all specimens caught at Río Piedras during the

winter in the forenoon were empty, while those of the early afternoon were always full. Only fifteen lizards that had recently eaten were examined: one small one from near the beach west of Arecibo, five from near the beach between the Condado and Pt. Cangrejos and the remainder from the garden, pastures or cane fields around Río Piedras. Because the records are so interesting, they are given in detail, the percent eaten by each individual being noted after the food, followed in parenthesis by the number of insects or other objects in the stomach and the point of collection.

DETAILED RECORD OF THE FOOD OF 15 *Ameiva exsul* Cope

Agaric mushroom 100% (1 Río Piedras)
Earthworm 45% (1 Río Piedras)
Snails 8% (1 Río Piedras), 20% (1 Río Piedras)
Millipede 2% (1 Río Piedras)
Sand Fleas 65% (50—more or less—Pt. Cangrejos)
Large sawbug-like Crustacean 15% (1 Pt. Cangrejos)
Attid spiders 15% (3 Pt. Cangrejos), 4% (1 Arecibo)
Earwig 1% (1 Río Piedras)
Cockroaches:
Periplaneta americana Linn. 20% (1 Río Piedras), 50% (1 R. P.)
Epilampra wheeleri Rehn 30% (1 Río Piedras)
Very small nymph 5% (1 Río Piedras)
Grasshoppers:
Plectrotettix gregarius Sausurre 15% (1 Pt. Cangrejos)
Schistocerca columbina Thunberg 70% (1 Pt. Cangrejos)
Crickets:
Ellipes minuta Scudder 10% (2 Arecibo)
Amphiacusta caraibea Sausurre 10% (1 Pt. Cangrejos), 20% (1 Pt. Cangrejos)
Hymenoptera:
Solenopsis geminata Fabr. 1% (1 Arecibo)
black bee 10% (leg and mouth parts only, Pt. Cangrejos)
Coleoptera, beetles or their larvae:
Histerid beetles 40% (4 Pt. Cangrejos)
Hymenorus sp. 10% and 3% (2 Pt. Cangrejos)
Zophobas sp. (determined by Mr. St. George), 10% (1 larva Río P.)
Monocrepidus bifoveatus P. B. 15% (1 Pt. Cangrejos), 2% (1 larva at Pt. Cangrejos), 30% (1 Arecibo)
Lachnosterna portoricensis Smyth 60% (3 larvae at Río Piedras), 2% (2 eggs at Río Piedras)
Cryptocephalus sp. 5% (1 Arecibo)

Lepidoptera:
Arctiid caterpillar 5% (1 Río Piedras)
Noctuid caterpillars 15% (1 Pt. Cangrejos)
15% (1 Pt. Cangrejos)
20% (1 Río Piedras)
30% (8 Río Piedras)
100% (2 Río Piedras)
38% (8 Río Piedras)
30% (1 Río Piedras)
60% (1 *Laphygma frugiperda* S. & A.)
20% (1 Río Piedras)
Noctuid pupa 10% (1 Río Piedras), 2% (1 Río Piedras)
Noctuid moth 30% (1 Río Piedras)
Pyralid caterpillars 20% (4 Arecibo)
12% (3 Río Piedras)
80% (10 Río Piedras)
30% (1 Río Piedras)

Diptera:
Sarcophagid maggots (determined by Mr. Greene) 100% (50 more or less, at the Condado—from carrion)
Asilid flies, Proctacanthus rufiventris Macq., 25% (1 Pt. Cangrejos), 5% (legs only, from Pt. Cangrejos)

Hemiptera:
Pentatomid bug, *Arvelius albopunctatus* P. B., 15% (1 Pt. Cangrejos)
Cydnidid bug, *Rhytidiporus indentatus* Uhler, 20% (1 Pt. Cangrejos)

Homoptera:
leafhoppers, *Draeculacephala sagittifera* Uhler, 30% (6 Arecibo)
Fulgorids, *Ormenis marginata* Brunnich 20% (1 Pt. Cangrejos), & 5% (1 nymph)
Ground pearls, *Margarodes formicarium* Guilding 3% (1 Pt. Cangrejos), 2% (1 Pt. Cangrejos)

Lizard eggs: 20% (2 Río Piedras), 60% (1 Río Piedras)

SUMMARY

Mushrooms 6.7%
Earthworms 3%
Snails 2%
Millipede .1%
Sand Fleas 4.3%
Sowbugs 1%
Spiders 1.3%
Orthoptera 15%
Hymenoptera 1%
Coleoptera 12%
Lepidoptera 34.5%
Diptera 8.7%
Hemi-Homoptera 6.3%
Lizard eggs 5.3%

The only elements in the food of these fifteen specimes that can be considered as in any way beneficial are the spiders, the earwig,

possibly the Asilid flies, and the lizard eggs, which altogether total only 8.7 per cent.

Altho no *changa* happened to occur in the stomachs of any of the *iguanas* examined, the readiness with which other Orthoptera are eaten would indicate that the absence of the *changa* is due merely to the accidents of collection, in that not sufficient specimen were examined. The point most especially to be noted is that three white grubs had been eaten by one *iguana,* and two *Lachnosterna* eggs by another. These may have been obtained from a field being plowed, but none were near where these specimens were collected, and presumably these grubs and eggs were obtained by burrowing. The large number of caterpillars (or pupae or moths)—46, some of which could be positively identified as injurious species, eaten by 15 *iguanas*—and constituting over a third of the total food, needs no comment.

The *iguana,* because of its burrowing habits and consequent ability to obtain white grubs and presumably other soil-inhabiting grubs for food, because of its large size and consequent ability to eat large insects, or large numbers of smaller ones, and because it eats so few insects which can possibly be considered beneficial, and so many that are injurious, is undoubtedly one of the most valuable wild animals in Porto Rico.

Mabuya sloanii Daudin

The "skink," altho having a rather wide distribution in the West Indies, is rare in Porto Rico. During the course of the investigation, only two were observed, a pair in the valley of the Río Loco near Yauco. One was with difficulty captured by Mr. Seín, and found to have eaten one large cricket nymph, *Grillus assimilis* Fabricius.

Hemidactylus mabouia Moreau de Jonnes

All the geckos observed were light yellow in color with black eyes, and altho somewhat clumsy in appearance, proved surprisingly agile in eluding capture. All noted appeared at night on the ceiling of houses, around electric lights, where they caught the insects attracted to the lights.

Sphaerodactylus macrolepis Gunther

The "salamanquita" or Santa Lucía is moderately abundant in the soil or under piles of cane trash, but none were dissected for

stomach examinations. All collected had been kept alive in captivity a day or more before being brought to the laboratory, and upon being released one established headquarters there, being several times found under botanical specimens.

Anolis cuvieri Merrem

Most of the lizards found in Porto Rico belong to the genus *Anolis,* and of these possibly the rarest and certainly the largest is the giant green lizard, *Anolis cuvieri.* Only one specimen was collected, from a ceiba tree in the Ciales valley about 6 kilometers south of Manatí, and it had eaten four quite large snails. Dr. B. H. Ranson, of the Bureau of Animal Industry of the U. S. Department of Agriculture, identified a fluke found in the stomach with the snail remains as a "mature distome fluke, presumably a normal parasite of *Anolis cuvieri.*"

Anolis evermanni Stejneger

Anolis evermanni Stejneger is a green lizard, found only in Porto Rico, that is common only in the higher mountains. It was not found in the mountains south of Ciales at kilometer 30, but a single specimen was collected at Jajome Alto between Cayey and Guayama, and the remaining nine specimens were collected on El Yunque, above Santa Catalina (the type locality) but still within the coffee grove. Most of the insects eaten are pests of, or occur on, coffee trees and *Inga vera.*

Only one lizard had eaten spiders, and another had eaten a snail, but these were the only elements of food which were not insects, and they totaled only 1 per cent.

One lizard had eaten a winged termite, another four springtails, a third an undetermined Psocid.

Three lizards had eaten "hormiguilla," *Myrmelachista ambigua ramulorum* Wheeler, and this ant constituted 3 per cent of the total food. The "albayalde," *Wasmannia auropunctata* Roger, had been eaten by two lizards, and *Tapinoma melanocephalum* Fabricius by one, which, together with the unidentified ant fragments, brought the total for ants up to 5.4 per cent. Two small wasps, possibly *Tetrastichus* sp., had also been eaten.

Beetles constituted almost half (41.4 per cent) of the total food, but nearly half (20 per cent) were beneficial Lampyrids, *Callopisma borencona* L. & M., *Lucidiota decorus* G. & H., and *Photinus dubiosus* L. & M., being identified. The other beetles were: *Monocrepidus*

bifoveatus P. de Beauvois—the tobacco wireworm, *Cryptocephalus nigrocinctus* Suffrian, a small red and black Cerambycid beetle (unidentified), and 32 individuals of *Platypus ratzeburgi* Chapuis which has repeatedly been observed boring in the trunks of *Inga vera.*

Caterpillars and moths constituted 11 per cent of the food of the lizards examined, one large Noctuid moth being four-fifths of what one lizard had eaten.

Bibionid and Agromyzid flies constituted only half of one per cent of the food, and two unidentified Hemiptera were less than one per cent. Strange and for the most part undescribed Fulgorids constituted over a quarter of the food (26.8 per cent). These Fulgorids were mostly mottled with grey and brown and live on the bark of trees.

Of the leafhoppers, four *Xestocephalus pulicarius* Van Duzee, which is sometimes found on the tender shoots of coffee, and two Deltocephalus sp. had been eaten. Twelve of the *Inga vera* Psyllids, *Psylla municoma* Crawford, had been eaten by three lizards and constituted 5.3 percent of the total food, and brought the total for Homptera up to 37.6 per cent.

No vegetable food had been eaten by any of the ten lizards examined.

SUMMARY

Beetles and bugs constitute four-fifths of the food of the green lizard of the mountains, and ants and moths and caterpillars most of the remainder. Unfortunately, nearly half of the beetles eaten are predaceous and presumably beneficial. But all of the other beetles eaten are more or less injurious, and the one of which greatest numbers were eaten is a serious pest of *Inga vera.* The psyllids which feed on the leaves of *Inga vera* are commonly eaten, as well as leafhoppers of coffee, and the ants "hormiguilla" and "albayalde" which are pests on both kinds of trees.

Anolis pulchellus Dumeril & Bibron

Anolis pulchellus is the small greenish-brown lizard with the yellow sides which is so common in Porto Rican grasslands and canefields. It is possibly the most abundant species occurring in the Island and certainly is most important economically because of the large number of the smaller insect pests of sugar cane and forage grasses which it destroys.

Fifty lizards of this species were collected at Río Piedras in September and October, in upland meadows and pastures, and from cane fields.

Three small snails had been eaten by these lizards, and two were still alive when removed from their stomachs. Eight sowbugs had been eaten by four lizards, a millipede had been eaten by another and small centipedes by two others. The spiders were a considerable item of food, forty-two having been eaten by half the lizards and constituting nearly 4 per cent of all food. Most of the spiders were small Araenids, but several quite large Attids were also eaten. Forty small mites determined by Dr. Ewing as Lohmannia sp. had been eaten by six lizards, and in two cases formed a third of the food. The total amount of invertebrate food other than insects amounted to nearly 8 per cent.

Two small cockroaches, two earwigs and one small changa, *Scapteriscus vicinus* Scudder, had been eaten by as many lizards and formed from 10 per cent to 20 per cent of the food in each case. One Damsel fly, *Enallagma* sp. (Odonata), had been eaten by one lizard and occupied nearly half his stomach.

Ants constituted one-fifth of the food eaten. The species varied in size from *Odontomachus haematodes* Linnaeus to *Tapinoma melanocephalum* Fabricius, and altho soldiers and winged adults were most often eaten, the smaller workers were not overlooked. Twelve individuals of *Odontomachus* were eaten, and constituted a quarter of the food of the six lizards that ate them, as did also the soldiers and workers of *Pheidole fallax jelskii antillensis* Forel, of which 34 were eaten. Nine "hormiga brava", *Solenopsis geminata* Fabricius, were eaten and 28 "albayalde", *Wasmannia auropunctata* Roger. The two species of *Tapinoma melanocephalum* Fabricius and *littorale* Wheeler, were also found in considerable numbers, as well as:

Anochetus mayri Emery	1 %
Monomorium pharaonis Linnaeus	1.5%
M. ebeninum Forel	.1%
Cardiocondyla emeryi Forel	.3%
C. venustula Wheeler	.2%
Tetramatorium simillimum F. Smith	.8%
Atta smithi borinquensis Wheeler	.1%
Cyphomyrmex rimosus minutus Mayr	.2%
Iridomyrmex melleus Wheeler	.4%
Brachymyrmex heeri Forel	
Prenolepis longicornis Latreille	

Two lizards had eaten *Apanteles* wasps, one a small yellow and black Chalcid and three *Eurytoma* sp. (?) wasps, but the *Hymenoptera*, aside from the ants, amounted to only 1 per cent of the total food eaten.

The beetles constituted nearly 5 per cent of the total food, and abount a sixth of the food of the lizards that ate them. None of the beetles were large; but *Cerotoma denticornis* Fabricius, the leaf beetle; *Epitrix cucumeris* Harris, a tobacco flea-beetle; and *Cylas formicarius* Fabricius, the "piche" of sweet potatoes, one of each of which had been eaten, are important economic pests. The other beetles were identified as *Phaenonotum estriatum* Say, *Aphodius granarius* Linaeus, *Loberus testaceus* Reitter, *Xantolinus* sp. (7 eaten) and *Stephanoderes* or *Xyleborus* sp. (7 eaten).

Lepidoptera constituted over a fifth of the food. Twenty-five moths had been eaten by fourteen lizards and averaged over half of their food. None were in such shape that they could be specifically identified, but several Noctuids, many Crambids and a number of Acrolophids were noted, altho most were small Micros. Twenty-one caterpillars had been eaten by fifteen lizards and averaged over a quarter of their food. One *Laphygma frugiperda* S. & A. was identified and many of the others were Crambids, probably in some cases *Diatraea saccharalis* Fabr.

Minute flies of the families Mycetophylidae, Bibionidae, and Agronomyzidae were eaten by more than half the lizards, and in large numbers by some of them, often forming a third or a fourth of their food. One hundred thirty individual flies had been eaten and constituted over an eighth of the total food.

Twenty-four thrips of various species had been eaten by ten lizards, but because of the small size of the individuals, they formed an insignificant fraction of the food.

Forty chinch bugs, *Blissus leucopterus* Say, had been eaten by eighteen lizards, and constituted a quarter of their food. It appears quite possible that the main reason why the chinch bug is practically unknown as a pest of corn, rice and sugar-cane in Porto Rico is because it forms such an important item of food for lizards. Its size, comparatively slow movements and high visibility render it especially well adapted to be eaten by lizards of grass and low vegetation. The only records of the chinch bug being common enough to become a pest are in the plantations of guinea grass of the northwest coast, especially around Hatillo.

Together with another Lygaeid bug, *Orthaea bilobata* Say, and a Capsid, the chinch bugs constituted over one-tenth of the total food.

The leafhoppers formed one-fifteenth of the total food, the species identified being:

5	*Kolla similis* Walker	1.6 %
21	*Kolla fuscolinecella* Fowler	1.5 %
11	*Xestocephalus pulicarius* Van Duzee	1.2 %
7	*Deltocephalus flavicosta* Stal	1.5 %
3	*Chlorotettix* sp.	.3 %
2	*Eugnathodus bisinuatus* DeLong	.14%
2	*Protalebra brasilensis* Baker	.3 %

Twenty-one individuals of *Kolla fuscolinecella,* thirteen adults and eight nymphs had been eaten by one lizard and were three-fourths of what it had eaten. *Kolla similis* is by far the most abundant leafhopper on *malojillo* and other grasses in Porto Rico during wet weather, or growing on low ground but is quite scarce on the upland meadows where most of the lizards were collected. *Xestocephalus pulicarius* is also thought to be quite rare, but eleven individuals had been eaten by ten lizards.

The fulgorid, Oliarus cinereus Wolcott, altho common and readily seen, is quick and wary, but, together with unidentified species of *Liburnia,* it constituted over 5 per cent of the total food. Eleven lizards had eaten seventeen individuals of *Oliarus;* often it was a fourth or a fifth of all they had eaten.

Unidentified Psyllids amounted to 1.5 per cent of the total food, nineteen individuals having been eaten by seven lizards.

Fifty-eight aphids, all of which were *Aphis maidis* Fitch, the common species on *malojillo* grass, had been eaten by seven lizards, and constituted a sixth of their food. Unidentified yellow mealy-bugs were an even more important item of food, having been eaten by a quarter of the lizards and forming 2.3 per cent of all food.

One lizard had eaten the anthers from grass flowers, another an oval black seed, another a small stone, but aside from these items, all the food observed consisted of small invertebrates, mostly insects. The amount of beneficial insects eaten was negligible, while the number of chinch bugs, and corn aphids, presumably obtained from *malojillo* grass, eaten was so considerable as to be an important factor in their control, to say nothing of the occasional changa, bean-leaf beetle, tobacco fleabeetle, sweet potato weevil,

and the numerous fire ants destroyed. Most of the other insects are of slight importance to economic crops, under present conditions, but might develop into serious pests were the lizards not here to reduce their numbers.

For comparision with the data obtained at Río Piedras on the food of *Anolis pulchellus,* sixty additional lizards were collected from other parts of the Island. One was found in the swamp at Boquerón in November, three were from pastures near tobacco fields at Juncos in December, twenty-four were collected in the Ciales valley near Manatí in pastures and meadows close to the river during December, nine were from a pasture north of San Germán in March, five were from an uncultivated field at Toa Baja and eighteen were from low guinea-grass meadows in which malojillo grass had grown up in the furrows at Camuy, all collected in March.

Eight snails had been eaten and formed 1.8 per cent of all the food eaten, while only five sowbugs had been eaten and formed only .4 per cent of the food. Seven centipedes had been eaten, forming 1.5 per cent of the food. Had the spiders eaten by nearly half the lizards been divided among them all, there would have been a spider apiece. A few of the spiders were large Attids and formed a considerable portion of the food, but most of them were small Argliopoids and formed a tenth or less of the food of the lizard. They totaled 9.7 per cent of the food. Only one mite, *Lohmania* sp., was eaten.

Springtails had been eaten by two lizards.

Nymphs of a small grasshopper, *Conocephalus cinereus* Thunberg, had been eaten by seven lizards and in several cases entirely filled their stomachs. They totaled 5.75 per cent of the food of all.

The 82 ants eaten by the 60 lizards formed a ninth of their food—11.2 per cent. One-third of this number were of the species *Pheidole antillensis* Forel, and formed nearly half of the bulk. The large "berraco", *Odontomachus haematodes* Linn. (or its subspecies), bulked next largest, altho only nine were eaten. 15 *Monomorium destructor* Jerdon, 12 "albayalde" *Wasmania auropunctata* Roger, 8 *Tapinoma* sp., 2 unidentified Ponerids and 2 "hormiguilla" *Myrmelachista ramulorum* Wheeler were also found. Fourteen bees and wasps, some of them of considerable size, had been eaten and formed 5.5 per cent of the total food. Three bees, *Chloralictus* sp., two *Eurytoma* sp., one *Tetrastichus* sp., one *Micro-*

bracon sp., six *Apanteles* spp. and one *Splilochalcis femoratus* Fabr., were identified, the latter being parasites of destructive caterpillars and decidedly beneficial.

Altho only a few beetles were eaten, several were of considerable size and they totaled 5.2 per cent of the food. One *Coccinellid* larva was identified, two adult Chrysomelid beetles, *Crytocephalus nigrocinctus* Suffrian; and one Otiorhynchid *Lachnopus curvipes* Fabr.

Lepidoptera constituted over a fourth of the food (26.6 per cent.) Seven moths had been eaten, nine eggs, and forty-three caterpillars. Fifteen caterpillars were definitely identified as being *Mocis* (*Remigia*) *repanda* Fabr., a common cane and grass cutworm, of which outbreaks of considerable severity occurred at many points of the Island during the winter. Most of those eaten were quite small, and the importance of having them destroyed before they had done much damage makes their consumption by this lizard all the more valuable. Two and possibly more of the other caterpillars were *Laphygma frugiperda* S. & A., and several appeared to be *Diatraea saccharalis* Fabr., both important pests of sugar cane, and one was a bagworm, *Oeceticus kirbyi* Guilding.

Forty-three flies, totaling 5.4 per cent of the food, had been eaten, most of them being small Bibionids which do not bulk very large, besides a few Mycetophilids, Agromyzids, and Tipulids. Of those more specifically identified, the largest was *Pyrellia scapulata* Bigot; three were *Toxomerus laciniosus* Loew, a common Syrphid fly in high grass; and one was *Ensina humilis* Loew, a very small Trypetid fly.

Seventeen Hemiptera had been eaten by the sixty lizards and constituted 4.65 per cent of their food. Seven individuals of the Lygaeid bug, *Orthaea bilobata* Say, had been eaten, but one noted no chinch bugs, which formed such an important element, both in bulk and economically, in the food of the lizards at Río Piedras. The outbreak of chinch bugs which had appeared during the winter in the northwestern-corner of the Island had entirely disappeared by March when the lizards were collected at Camuy. The winter rains were undoubtedly responsible for the disappearance of the chinch bugs, and not the lizards, for the latter were scarce and could be found only in low pastures where *malojillo* grass was displacing the guinea grass. On the upland pastures, where the ground was covered with grama grass and abundant shelter was

afforded by high weeds and bushes, only a very few lizards were to be found, and in the guinea-grass fields, where the bunches were spaced 18 inches or 2 feet apart so that they could be cultivated, none at all were to be seen. Presumably, it is the long periods of drought and not some other factor, certainly not lack of food, which prevents *Anolis pulchellus* from being more abundant in this district, and which also provides the proper conditions for the chinch bug to become a serious pest.

Orthaea bilobata Say is recorded from numerous hosts, but at Manatí (where nearly half of the lizards were collected) it was noted as being very abundant on the ground under a *jaguey* tree, and had been eaten by several *Anolis stratulus* collected from this tree.

Of the other Hemiptera, the following were identified: one *Alydus pallescens* Stal, one *Chariesterus moestus* Burmeister, one *Corizus sidae* Fabr., one *Corizus hyalinus* Fabr., and one *Corythaica monacha* Stal.

A common leafhopper, *Kolla similis* Walker, largely took the place of the chinch bugs which had been eaten by *Anolis pulchellus* at Río Piedras. The lizards of this species collected at Río Piedras were from the Station grounds around the laboratory, and from a hill pasture, where *Kolla similis* is rarely abundant, even during the wettest weather. This leafhopper is very sensitive to moisture and occurs most abundantly along stream or ditch margins on *malojillo* grass, extending its range only during periods of abundant rainfall. Most of the *Anolis pulchellus* collected away from Río Piedras were from low pastures along stream margins, where Kolla similis is common, and that it should form 9 per cent of the total food of the lizards is not suprising. Thirty-four leafhoppers of this species were eaten by seventeen lizards, as compared with an equal number of all other kinds (which, however, bulked only 5.75 per cent) eaten by twenty-eight lizards. Those identified were:

6 *Kolla fasciata* Walker
4 *Xestocephalus pulicarius* Van Duzee
10 *Deltocephalus flavicosta* Stal (or spp.)
4 *Thamnotettix colonus* Uhler
3 *Chlorotettix* spp.
4 *Eugnathodus bisinuatus* DeLong
3 *Protalebra brasilensis* Baker

The Fulgorids formed 6.3 per cent of the food of the sixty lizards, forty-nine having been eaten; eight being *Delphacodes teapae* Fowler, thirty-eight other species of *Delphacodes*, two *Oliarus cinereus* Wolcott and one Sogota cubanus Crawford, all being common species on grass.

One Membracid, *Monobelus, fasciatus* Fabr., six grass Psyllids (unidentified), five aphids of which two were *Aphis maidis* Fitch, three mealybugs, and one scale insect, *Saissetia nigra* Nietner from the remainder of the Homoptera eaten, amounting to 2.5 per cent of the total food.

Anolis krugii Peters

Anolis krugii, altho readily distinguished from *Anolis pulchellus* by the orange dewlap of the male and the broader head, and by the higher elevations and more shaded habitat in which it occurs, is similar in general appearance and habits. Its food is the same in general as that of *A. pulchellus,* with a few minor, but interesting, exceptions, largely due to the difference in abundance of some species of insects at the higher altitudes.

Two *Anolis krugii* were collected in a coffee grove near Maricao in November, six from a sweet potato patch near Cayey in the same month, nine from a mountain meadow near Aibonito in January and thirteen from a pasture south of Ciales in March, making a total of thirty specimens examined.

Five snails had been eaten, forming 1.6 per cent of the food. Twelve sowbugs, forming 33 per cent of the food, had been eaten by six lizards. Spiders, in a few cases Attids, but usually Agriopoids, had been eaten by almost half of the lizards and formed 6.8 per cent of the total food. One male cattle tick, *Margaropus a. australis,* as determined by Mr. F. C. Bishopp, had been eaten by one of the lizards from Cayey.

Another lizard from Cayey had eaten an earwig, *Anisolabis ambigua* Borelli, and the remains of a cricket were found in the stomach of one from Ciales. Another from Ciales had eaten a springtail.

The ants formed one sixth of the total food, but altho *Pheidole antillensis* Forel was second in bulk and numbers, unidentified Ponerine ants were most abundant. The "albayalde" *Wasmannia auropunctata* Roger and *Tapinoma* sp. were third and fourth, and two specimens of Atta (*Mycoceporus*) *smithi* Forel var. *borinque-*

nensis Wheeler had been eaten by lizards from Ciales. Five *Apanteles* wasps and two other small wasps had been eaten, but they formed only 1.3 per cent of all the insects eaten—the only beneficial insects eaten by this species of lizard, and quite overbalanced by the 88 per cent of neutral or destructive insects which it had eaten.

Beetles formed 4.5 per cent of the total food. Those identified were: one *Philhydrus* sp.; two *Chaetocnema apricaria* Suffrian eaten by a lizard at Cayey, where they had doubtless been feeding on the sweet-potato leaves; one *Photinus dubiosus* L. M. & M. and one *Apodrusus wolcotti* Marshall eaten by the lizard from Maricao —the first a firefly, the latter an Otriorhynchid which feeds on the leaves of *Inga vera.*

Lepidoptera formed a third of the total food eaten (33. per cent), which is a much larger proportion than that of any of the other small lizards, and consisted of seven moths and twenty-seven caterpillars. At least four of the latter appeared to be *Mocis repanda* Fabr. and one *Diatraea saccharalis* Fabr.

One thrips had been eaten by a lizard from Ciales.

Diptera constituted 9.4 per cent of the total food. Ten Bibionids, five Agromyzids, three small Muscids and two Tipulids (all unidentified as to genus) and one Dolichopodid, *Psilopus caudatus* Wiedemann together constituted scarcely half the bulk of the flies; one *Pyrellia scapulata* Bigot and three large maggots made up the rest.

Eight *Orthaea bilobata* Say constituted the larger portion of the Hemiptera eaten (3.4 per cent), the others being an unidentified Capsid, possibly a species of *Poeciloscytus,* and nymphs that could not even be assigned to a family.

Of the eighteen leafhoppers eaten, eleven were *Kolla fasciata* Walker and only four *Kolla similis* Walker. The former is very seldom found at the lower elevations and is mostly a leafhopper of mountain grasslands, while the latter is commonest along stream margins. One *Xestocephalus pulicarius* Van D., *one Thamnotettix colonus* Wheeler and one Protalebra brasilensis Baker had also been eaten, making a total of 8 per cent of all food consumed.

Of the nine Fulgorids, constituting 6 per cent of all food, most were species of *Delphacodes,* especially *teapae,* but a lizard from Maricao had eaten only an *Oliarus cinereus* Wolc. Eleven grass

Psyllids, two aphids and one mealybug bring the total for all the Hemiptera to 16.5 per cent.

SUMMARY

Combining all the records on *Anolis pulchellus* and *Anolis krugii*, the large number of moths and caterpillars eaten is especially noticeable. While some of these may be indirectly beneficial, in that they feed on weeds that otherwise might have to be destroyed by cultivation, yet some and possibly most the caterpillars are directly injurious. The leafhoppers and other bugs (Hemiptera-Homoptera) may not be especially injurious to cultivated crops, yet when an outbreak of the chinch bug threatens in a region where lizards are normally abundant, by a slight change in their food from the leafhoppers and other bugs, the incipient outbreak will be prevented. In the same way, even tho many of the caterpillars which the lizards feed on are normally of little importance, yet when an outbreak of grass loopers or cutworms threatens, the lizards will eat large numbers of these injurious caterpillars while they are still small and before they have done serious damage. Many of the ants eaten are injurious to agriculture, and those that are neutral will not be missed. The only elements in the food of the lizard that are beneficial are the parasitic wasps and the predaceous spiders and beetles and earwigs. But these form such a small part of the food of this lizard as compared with the major portion of its food which consists of injurious insects that it may be considered very decidedly beneficial.

Anolis stratulus Cope

Anolis stratulus is a medium-sized to small lizard, grey or darker colored, most often found in the upper branches if large trees. It can be most readily distinguished by the dark colored saddle-spots along the back, which are most obvious in the ligher-colored specimens, and by the bluish iris of the eyes. When it begins to rain, these lizards descend from their elevated stations in the tree, to its trunk, or, if that begins to get wet, go into holes in the ground, and during rainy weather a surprisingly large fraction of their food consists of insects obtained from the grass and other vegetation around the base of the tree which serves as their look-out post.

Fifty lizards of this species were collected between September

1923 and March 1924; fifteen from *guamá* and *jagüey* trees at Aibonito, two from *búcar* trees at Cayey, eight from *guamá* and coffee trees at Maricao, eleven, from an *jagüey* tree at Manatí, thirteen from *almendro* and *bucar* trees at Río Piedras and one from a coconut palm near the beach at the Condado.

Seven spiders formed 2.86 per cent of the total food, and had been eaten by as many lizards, of which they formed 20 per cent of the food.

Three grass mites, *Lohmannia* sp., as determined by Dr. Ewing, had been eaten by two lizards, but formed only a minute fraction of their food.

One springtail had been eaten.

One cockroach, *Ceratinoptera diaphana* Fabr., and one cricket (unidentifiable) had been eaten, besides 2 earwigs, one of which was *Doru albipes* Fabr., 1 pupa of *Chrysopa collaris* Schneider and 10 Psocids, *Caecilius* sp., totaling a little over 5 per cent of the total food.

Five hundred ants, more or less, had been eaten by the lizards, and they formed a larger item in their food than any other kind of insect, being considerably over a fourth of the total food. Nearly half of the ants were of one species, the "hormiguilla" *Myrmelachista ambigua ramulorum* Wheeler, of which 220 had been eaten and formed 12 per cent of the total food, and nearly half of the food of the lizards eating them. About 70 "albayalde", *Wasmannia auropunctata* Roger had been eaten, altho they did not amount to as much in bulk as did 7 *Pheidole fallax jelskii antillensis* Forel. Thirty-two "hormiga brava", *Solenopsis geminata* Fabr., 62 ants of various species of *Monomorium*, 10 *Iridomyrmex melleus* Wheeler, a number of *Prenolepis longicornis* Latr., and other unidentified ants had also been eaten.

Two small fig wasps, *Idarnes* sp., as identified by Mr. P. H. Timberlake, had been eaten by one lizard from a *jagüey* tree, and the lizard from Condado beach had eaten a small bee, which could not be identified.

Twenty-eight beetles had been eaten by as many lizards, forming 5.32 per cent of the total food, but in no case did a beetle form as much as half of the food of any one lizard. Eight Hydrophylid beetles, *Phaenonotum estriatum* Say, as determined by Dr. Schwarz, had been eaten by the lizard on the Condado beach. One *Loberus testaceus* Reitter, 2 Coccinellid larvae, 1 *Lasioderma serricorne*

Fabr., two unidentified Tenebrionids, 2 *Platypus ratzeburgi* Chapuis, one *Xyleborus* sp. and five *Stephanoderes* sp. had been eaten, besides 2 *Crytocephalus perspicax* Weise, 1 C. *nigrocinctus* Suffrian and 2 larvae of these beeetles.

Fourteen moths formed 9.8 per cent of the total food eaten.

Nine Noctuid larvae, of which some were *Xylomiges sunia* Guenee and *Mocis repanda* Fabr., but of which most were unidentifiable, besides 14 Pyralid larvae, three of which were *Diatraea* sp., probably *saccharalis* Fabr., together formed 15.8 per cent of the total food, and in many cases, were all, or nearly all, the lizard had eaten. The total Lepidoptera eaten were slightly over a quarter, and together with the ants, considerably over half of all the food eaten by this species of lizard.

One hundred and forty-six flies (as nearly as could be determined) had been eaten by the fifty lizards and constituted 14.66 of their total food. The greater number of these flies were small Bibionids or Mycetophylids, which did not bulk very large even when many had been eaten. Of the larger flies, two *Pyrellia scapulata* Bigot, one *Anastrepha fraterculus* Weidemann, one *Tabanus pasammophilus* Osten Sacken were identified.

Four unidentified thrips had been eaten.

Seventy-six Hemiptera had been eaten and formed 28.28 per cent of the total food.

There were 3 Capsids, one of which was *Pycnoderes incurvus* Distant; 6 Lygaeids, of which two were *Blissus leucopterus* Say and four *Orthaea bilobata* Say; 5 Jassids, of which two were *Kolla similis* Walker; one was *Deltocephalus flavicosta* Stal one *Xestocephalus pulicarius* Van D.; 8 Fulgorids, of which two were *Ormenis* spp.; 7 mealybugs, *Pseudococcus* spp.; 1 scale insect, *Saissetia hemisphaerica* Targioni; 44 Psyllids (which were 4 per cent of the total food and the largest single item of the Hemiptera eaten) and, 2 Membracids, *Monobelus fasciatus* Fabr.

Two berries of *Cordia corymbosa* had been eaten by one lizard.

SUMMARY

Adding together all the predaceous insects eaten and the spiders gives only 5.26 per cent of the food of this lizard as being beneficial, while practically all the other insects eaten are actually or potentially injurious to agriculture. One quarter of the food is caterpillars or moths, and over a quarter ants, especially such

injurious species as the "hormiguilla," the "albayalde" and the "hormiga brava."

Anolis cristatelus Dumeril & Bibron

Anolis cristatelus is the common large arboreal lizard, mottled with yellowish and greenish brown and sometimes deepening in color to almost black. The males are considerably larger than the females, and their prenuptial combats are sometimes long and fierce, but not sanguinary. This lizard is possibly the one which least fears man, and it is almost as common in and about houses in the country as on fence posts and trees.

One hundred adults of this species were collected: forty-two from mulberry, *almendro* or *bucar* trees or banana plants near the laboratory at Río Piedras, seven in the coffee grove at Vannina, south of Río Piedras, six from coconut palms or sea-grapes on the beach at the Condado, fourteen on fence posts surrounding tobacco fields at Juncos, nine in coffee groves at Ciales, four in coffee groves near Mayagüez, nine on coconut palms along the margin of a swamp near Boquerón and seven on trees growing along the dry bed of the Río Loco near Yauco, the first collection being made on September 15th, the last on December 28, 1923. They had eaten—

11 snails, which were 1.95% of the total food, or 23% of the food for 9 lizards;
24 sowbugs, 1.42% of the total food, 12% of the food for 12 lizards;
5 millipedes, 1.95% of total food, 39% of the food for 5 lizards;
2 tailless scorpions, .7% of total food, 35% of the food for 2 lizards;
3 earthworms, 2.3% of total food, 77% of food for 3 lizards, and
30 spiders, 5.15% of the total food, 23% of the food for 22 lizards.

Eight of the spiders were the large *Heteropoda venatoria*, and one was the horned spider, *Theridula triangulata* Keyserling. The total of invertebrates, not including insects, is 13.47 per cent.

Of insects, the one hundred *Anolis cristatelus* had eaten eight cockroaches which constituted 4.14 per cent of the total food, or 25 per cent of the food for eight lizards, and of these, two were identified as *Batella* sp., one *Blatella delicatula* Guerin, one *Epilampra wheeleri* Rehn, one *Periplaneta australasiae* Fabricius,

two *Periplaneta americana* Linnaeus and one *Symploce flagellata* Hebard. Five earwigs had been eaten, which were only .85 per cent of the total food, but were 21 per cent of the food for four lizards, and these were identified as three *Phaulex albipes* Fabricius, and two *Anisolabis annulipes* Lucas, the latter determination being made by Mr. A. N. Caudell. Three crickets were 1.85 per cent of the total food and 62 per cent of the food for three lizards. They were *Ellipes minuta* Scudder, *Anurogryllus muticus* De Geer and *Amphiacusta caraibea* Saussure.

Three lizards had eaten four thrips, which were 2 per cent of their food, but constituted only .07 per cent of the total food. Two of these thrips which were found in the stomach of a lizard collected October 6th, 1923, on a banana plant at Río Piedras have been determined by Mr. A. C. Morgan to be new species of *Gastrothrips*.

Two lace-winged flies, *Chrysopa collaris* Schneider, had been eaten by as many lizards and formed 22 per cent of their food, but only .45 per cent of the total.

Of the Hymenoptera, 600 individuals had been eaten by 78 lizards, but twenty-six twenty-sevenths, or 579, of these were ants, nine were bees, and the remainder wasps. But the twenty-one bees and wasps constituted 30 per cent of the food of lizards eating them, or 6 per cent of the total.

The 578 Formicidae (ants) formed 17.73 per cent of the total food and had been eaten by three-fourths of the lizards. The species identified were as follows:

2 *Anochetus* sp.

20 *Odontomachus haematodes* Linnaeus, the "berraco," formed 2.01% of the total food, 15.5% of the food of the 13 lizards eating these large and apparently rather undigestible ants.

48 *Monomorium* sp. formed 1.42% of the total food.

85 *Solenopsis geminata* Fabr., the "hormiga brava," formed 1.69% of the food, having been eaten by 20 lizards.

90 *Pheidole fallax jelskii* Mayr, var. *antillensis* Forel, formed 4.38% of the total food, the large-headed soldiers making this species amount to practically one-fifth of the food of the 22 lizards which had eaten them.

14 *Pheidole subarmata* Mayr. var. *borinquensis* Wheeler, or some other species of *Pheidole* than *antillensis*, formed 1.07% of the total food, or one-fifth of the food of the five lizards which had eaten this species.

1 *Machomischa albispina* Wheeler (? det.).

35 *Wasmannia auropunctata* Roger, the "albayalde," formed 1.37% of the total food, or one-tenth of the food for 13 lizards.

4 *Strumigenys* sp.

130 *Tapinoma melanocephalum* Fabr. and *T. littorale* Wheeler formed 1.67% of the total food, or 18.5% of the food for 9 lizards.

21 *Brachymyrmex heeri* Forel, and var. *obscurior* Forel formed nearly 1% of the total food, or 14% of the food for 7 lizards.

97 *Prenolepis longicornis* Latreille formed 1.67% of the total food, but only 10% of the food for 16 lizards.

1 *Myrmelachista ambigua ramulorum* Wheeler, the "hormiguilla" had been eaten, altho none of the lizards collected from coffee groves were where shade trees noticeably infested with the hormiguilla were present.

7 *Camponotus ustus* Forel, a large yellow ant, formed .63% of the total food, or one-sixth of the food of the four lizards which had eaten it.

5 Honey bees had been eaten by as many lizards and constituted nearly half of their food.

4 Other bees (unidentified) had been eaten by as many lizards, but, due to their smaller size, were not such a large fraction of the food.

1 *Polistes crinitus* Felton, a large wasp, had been eaten by a lizard from a coffee-grove at Ciales.

1 Large Ichneumonid had been eaten by a lizard from Boquerón.

1 *Spilochalcis femorata* Fabr. had been eaten by a lizard at Yauco.

2 *Apanteles* spp. had been eaten by as many lizards, of which these small wasps constituted only 1% of the food eaten, as did also

1 *Tetrastichus* sp.

2 *Elis haemorrhoidalis* Fabr., females, had been eaten by a lizard at Juncos, and constituted 20% of his food.

4 *Chelonus insularis* Cresson had been eaten by lizards from Boquerón and Yauco.

Ninety-two Coleoptera (beetles) formed 16.21 per cent of total food, or one-fourth of all food for 65 lizards. Those identified were:

2 Carabids, *Solenophorus* sp.

6 Hydrophyllids

2 Staphylinids, *Xantholinus* sp.

11 Lampyrids (2.84% of total food, 28% of all food for 11 lizards):
- 1 *Lucidiota decorus* G. & H.
- 1 *Callopisma borencona* L. & M.
- 9 *Photinus vittatus* Olivier.

2 Cucujids, *Telephanus pallidulus* Chevrolat

1 Cryptophagid, *Loberus testaceus* Ritter

7 Coccinellids:
- 6 *Exochomus* sp., eaten by the lizards from the beach
- 1 *Cryptolaemus montrouzieri* Mulsant—an introduced beetle.

3 Tenebrionids

6 Bostrychids:
- 2 *Dinoderus minutus* Fabr.
- 4 *Tetrapriocera tridens* Fabr., eaten by a lizard from Boquerón.

3 Scarabaeids:
- 1 *Ataenius marginatus* Fabr.
- 1 *Ataenius stercorator* Fabr.
- 1 *Lachnosterna citri* Smyth, eaten by a lizard from the beach.

2 Cerambycids:
- 1 ***Leptostylus*** sp.
- 1 *Lepturges guadeloupensis* F. & S.

7 Chrysomelids:
- 1 *Lema nigripes* Weise
- 1 *Cryptocephalus nigrocinctus* Suffrian
- 1 *Nodonata wolcotti* Bryant, eaten by a lizard from Boquerón
- 1 *Disonycha laevigata* Jacoby, eaten by a lizard from Juncos
- 3 *Epitrix parvula* Fabr., eaten by one lizard from Río Piedras.

22 Curculionids:
- 2 *Cylas formicarius* Fabr., the sweet-potato weevil
- 6 *Diaprepes spengleri* Fabr., the sugar-cane root-boring weevil, forming nearly half of the food of four lizards
- 2 *Lachnopus curvipes* Fabr.
- 2 *Baris torquatus* Olivier, the eggplant stem borer
- 1 Chryptorhynchid
- 6 *Anchonus suillus* Fabr.
- 2 *Cosmopolites sordidus* Germar, the banana root-borer weevil
- 1 *Calendra linearis* Herbst, the tamarind seed weevil.

5 Scolytids:
- 2 *Stephanoderes* sp.
- 3 *Xyleborus* sp.

8 unidentified, .4% of total food
5 larvae
1 pupa

Fifty-nine caterpillars, moths or butterflies (Lepidoptera) formed 17.3 per cent of the total food, or one-third of the food of over half of the lizards. Two butterflies and five moths had been eaten, the remainder being caterpillars, of which two were Arctiids, *Ecpantheria icasia* (*eridanus*) Cramer. These had been eaten by as many lizards and formed their only food. Possibly the stiff black hairs with which these caterpillars are covered temporarily eliminated the lizards' appetite for other food. A fourth or possibly more, of the caterpillars were Noctuids and five were positively identified as being *Xylomiges sunia* Guene or *X. eridania* Cramer, and three as being *Mocis* (*Remigia*) *repanda* Fabricius. Nine lizards had eaten a Crambid larva apiece, and one of these was identified by Mr. T. E. Holloway as being *Diatraea* and probably *saccharalis* Fabricius. Six bagworms, *Oeceticus kirbyi* Guilding had been eaten by five lizards and formed 30% of their food. Another lizard had eaten two larvae of the Tineid bagworm, *Tineola uterella* Walsingham. Four larvae which appeared to be *Acrolophus* sp., an important pest of pastures, had been eaten by as many lizards.

Sixty-five flies, or their larvae or puparia (Diptera), formed 6.6 per cent of the total food, or one-seventh of the food for nearly half of the lizards. There were twelve Tipulids, one Psycholdid, three Culicids, two Mycetophylids, eight Bibionids, one Stratyomyid, *Neorondania chalybea* Wiedemann, which formed 40 per cent of the food of the lizard that ate it, two Phorids, five Syrphids, *Toxomerus* spp., eaten by the lizards around the tobacco fields at Juncos, five Muscids, of which three were *Pyrellia scapulata* Bigot, a blue-green irridescent fly, two Ortalids, *Euxesta* sp., two Mycropezids, *Calobata lasciva* Fabricius and the undescribed *Calobata* of the coffee groves, which had been eaten by the lizard from Mayagüez, one Drosophilid, eleven Agromyzids, eight larvae and one puparium.

Thirty-two bugs (Heimptera-Heteroptera) formed 3.68 per cent of the total food, and 26 per cent of the food for fourteen lizards. The large stink bugs (Pentatomidae) often constituted a third or more of the stomach contents of the lizard that had eaten one. Of the Hemiptera identified, three were *Teleonemia sacchari*

Fabricius; four were chinch bugs, *Blissus leucopterus* Say; two *Orthaea bilobata* Say; two *Largus varians* Stal, which formed 90 per cent of the stomach contents of the lizard eating them, from Mayagüez coffee grove; one *Spartocera batatas* Fabricius; one *Edessa bifida* Say, and two *Thyanta perditor* Fabricius.

Thirty-six Homoptera, including cicadas, leafhoppers, aphids, mealybugs and scale insects, formed 3.46 per cent of the total food and less than a seventh of the food for 27 lizards. A cicada, *Proarna hilaris* Germar, was all that one lizard had eaten and formed a large part of the food of another. The leafhoppers eaten were two *Kolla similis* Walker, one *Draeculacephala sagittifera* Uhler, one *Xerophloea viridis* Fabricius, one *Xestocephalus pulicarius* Van Duzee and one *Deltocephalus flavicosta* Stal. The Fulgorids included two *Bothiocera venosa* Fowler, three *Oliarus cinereus* Wolcott, one *Tangia angustata* Uhler, three *Ormenis marginata* Brunnich and two *Ormenis pygmaea* Fabricius. Three aphids, *Aphis maidis* Fitch, were 20 per cent of the food of one lizard. Six yellow mealybugs had been eaten by four lizards and five scale insects Saissetia oleae, Bernard, formed 70 per cent of the food of a lizard caught on an *almendro* tree infested with these scales.

The food of *Anolis cristatelus* by no means consists entirely of insects and other invertebrates. They had eaten fifteen red berries from various trees and bushes, *Cordia corymbosa, Volkameria aculeata*, and *Solanum seaforthianum* being specifically identified. These berries, constituted 5.19 per cent of the total food or 56 per cent of what eight lizards had eaten. Three lizards, apparently of the same species, had been eaten by as many lizards, the leg and tail usually being found, and constituted two-thirds of the food. This does not include the cases of lizards eating their own cast-off skins, which was quite common. In some cases this exuvia almost filled their stomachs. A white pigeon feather constituted half of what one lizard had eaten, and two stones, a root and some sand constituted small fractions of what other lizards had eaten.

SUMMARY

The food of Anolis cristatelus contains a larger portion of elements that are potentially or actually beneficial to man's economic interest than that of any other common lizard studied. The 2 per cent of lizards, 6 per cent of bees and wasps, mostly beneficial, .78 per cent of Coccinellid beetles, .45 per cent of Carabid beetles,

2.84 per cent of Lampyrid beetles and 5.15 per cent of spiders totals 17.19 per cent of beneficial elements. Six and seven hundredths per cent of such neutral elements as berries, roots, stones, sand and feathers, leaves 76.73 per cent of the food containing the injurious and neutral insects. But the list of injurious insects positively known to be eaten is a long one and includes such large and indigestible beetles as the "caculo" or May beetle, the "vaquita" or weevil root-borer, and the banana root-borer weevil, besides large numbers of smaller beetles, ants, caterpillars and bugs, and much more than counterbalances the beneficial insects.

Anolis gundlachi Peters

Anolis gundlachi Peters is a large brown lizard, occurring only in the higher mountains of Porto Rico, and "in many respects resembles *A. cristatellus*, which also has a caudal fin and a brownish ground color." (Stejneger.) It is not rare at the high elevations at which it occurs, but only ten specimens were collected: six between Lares and the Río Blanco at the highest point on the Lares-Yauco road, on November 6, three on the Ciales-Villalba road, 18 kilometers south of Ciales on April 30th, and one above Santa Catalina on the lower slopes of el Yunque, May 9th.

Two lizards had eaten snails and these constituted 10 per cent of the total food. One had eaten a grass mite, *Lohmannia* sp., another a large spider, *Agriope* sp., a third a white spider nest. Four lizards had eaten winged termites, most of which were *Nasutitermes morio* Latr., and these constituted 5.6 per cent of the total food, or slightly more than the Arachnids. One lizard had eaten what appeared to be the head of a dragon fly, and this was 70 per cent of its stomach contents.

Ants constituted nearly one-fourth of the total food (22.7 per cent). One lizard had eaten nothing but "albayalde," *Wasmannia auropunctata* Roger, and two had eaten "hormiguilla," *Myrmelachista ambigua ramulorum* Wheeler. Two had eaten the large "berraco," *Odontomachus haematodes* Linn., and a small amount of fragments of other ants were not identified.

Beetles constituted 10 per cent of the total food, and over half were Coccinellid larvae or their adults: *Psorolyma maxillosa* Sicard, *Cycloneda sanguinea* Linn. and one unidentified larva. A Platypus beetle, which breeds in *Inga vera* trees, had been eaten,

and *Cryptocephalus perspicax* Weise, which feeds on the foliage of the same tree.

Six caterpillars, half of which were Noctuids and half Geometrids, formed 18 per cent of the total food, and one small moth had also been eaten.

Nine flies, Mycetophilids, Tipulids and a Muscid, formed 5.3 per cent of the total food.

Two bugs, an Anthocorid and an Acanthiid, had been eaten and were 2.5 per cent of the food. One *Kolla similis* Walker and three *Xestocephalus pulicarius* Van Duzee amounted to nearly 6 per cent of the food furnished by leafhoppers, the *Inga vera* Psyllid, *Psylla minuticona* Crawford and an unidentified Fulgorid brought the total for Hemiptera-Homoptera up to 11.5 per cent.

The lizard from el Yunque had eaten two large seeds.

SUMMARY

The only food elements of the lizard that might be considered beneficial are the spiders and the Coccinellid beetles, and these amount to only about a tenth of the total food. Many of the other insects are neutral in their economic aspects, to the interests of man, but some of them, especially the ants, are decidedly injurious. The common coffee shade tree, *Inga vera*, furnishes food for many and various insects, and quite naturally, most of these insects are represented in the food of a lizard occurring where these trees are most abundant.

CONCLUSION

The results of the investigation conclusively prove that the lizards of Porto Rico are of very considerable economic benefit to the agricultural interests of the Island, and their value in preventing an enormous increase in numbers of some insects which we now think of as only minor pests, can with difficulty be realized.

"Few insects . . . have caused such enormous pecuniary losses as has the chinch bug (*Blissus leucopterus* Say). No other insect native to the Western Hemisphere has spread its devastating hordes over a wider area of country and with more fatal effects to the staple grains of North America than has this one." (7) "The chinch bug has damaged Kansas crops to a greater extent than has any other injurious insect, for, from the time the settlers began to plant the prairie to the present it has exacted merciless toll . . . Although there is no way to determine accurately the

money value of crops destroyed by the chinch bug since Kansas was first settled, it is safe to assume that the amount reaches many billions of dollars." (8) Yet the chinch bug is a very minor pest in Porto Rico and does appreciable damage only when the little yellow-striped grass lizard is rare.

This is the most striking instance of the economic value of lizards in Porto Rico, yet hardly more than equals the value of this same lizard in eating many small caterpillars before they become sufficiently numerous to cause serious damage.

The caterpillar which bores into the shoots and stalks of sugar cane (*Diatraea saccharalis* Fabricius) was noted with surprising frequency in the stomachs of several kinds of lizards, and this despite the protection which its burrowing habit would appear to give during most of its existence as a larva. It is a common and destructive pest of sugar cane, more especially in the dryer sections of the Island, and this may in part be due to the comparative scarcity of lizards along the south coast. But its abundance thruout the Island, and the damage it might cause, is undoubtedly limited by the presence of the lizards.

The ants eaten by lizards bulk large in their food, and this despite the small size of the individual ant. If ants at times seem especially abundant, one can well imagine how numerous they might easily become were the lizards not present in such abundance to destroy them.

There are many insects eaten by lizards which are at present neutral in their economic relations to the interest of man, and others that, altho attacking cultivated crops, are so rare that they are rather of academic interest than even minor pests. Yet if the lizards were not present to do their part in keeping down the numbers of insects, many of them might become very appreciably injurious.

Altho a considerable fraction of the food of the common large brown or black tree lizard, *Anolis cristatelus* proves to be of beneficial insects, yet it is a most valuable species because of its large size. It is large enough to eat such large, apparently unpalatable and hard-to-digest beetles as the weevil root-borer or "vaquita", *Diaprepes spengleri* Linnaeus, the banana root-borer, *Cosmopolites sordidus* Germar, and even the May beetles or "caculos", *Lachnosterna* spp. The *iguana,* Ameiva exsul, is amply large enough to eat such beetles, and does in fact eat the white grubs which are the im-

mature stages of the May beetles, but it is exclusively terrestrial and would rarely have the opportunity to catch the "vaquitas," which hide in the leaves of the trees where they feed. The *iguana* is also exclusively diurnal and the large tree lizard is so largely so that neither of them have any real opportunity to catch the May beetles, which are just as exclusively nocturnal. Indeed the white grubs have so few natural enemies in Porto Rico that the importation of additional ones from other countries offers one of the most promising methods of reducing numbers. Altho the small tree-toads or "coquís" are abundant in Porto Rico, there are no large nocturnal native toads large enough to eat May beetles. Such large toads are found in most of the other West Indies and on the mainland, and keep the number of May beetles, and their larvae, the white grubs, so reduced that they are seldom pests to cultivated crops. Mr. D. W. May of the Mayagüez Station, about four years ago obtained a dozen toads, *Bufo agua* Daudin, from Barbados, which were released here. They appear to be thriving and their descendants have been reported as far as four miles away from the point of release. Eventually, with an increase in their numbers, they will doubtless spread more widely over the Island, but it would be desirable to make other and larger importations of this or other species from Barbados or elsewhere, and immediately begin to obtain the benefits in decreasing the numbers of white grubs which would ensue from their presence in the canefields of Porto Rico.

Altho the nocturnal *Lachnosterna* beetles are rather rarely eaten by the large tree lizards its value in destroying not only such large diurnal beetles as the weevil root-borer and the banana root-borer, but also many other smaller beetles which are pests of various crops, should not be minimized. Beetles constitute a much larger part of its food than of any other common lizard, and very few of these beetles are beneficial.

There are no records of grasshoppers ever being sufficiently abundant in Porto Rico to be a pest of crops. That this is entirely, or even largely, due their being eaten readily by lizards can not be affirmed, but undoubtedly the lizards are a contributing factor. The number of cockroaches eaten is surprisingly large, considering their nocturnal habits, and presumably if they were active during the day, as are the grasshoppers, they would be no more abundant. Undoubtedly the reason why the *changa, Scap-*

teriscus vicinus Scudder, is so rarely eaten by lizards is because it is strictly nocturnal and largely subterranean in habits, and this again suggests the benefits to be derived from the importation of large nocturnal toads.

No mosquitoes, nor house flies, were found in any of the lizard stomachs examined, and the great bulk of the flies eaten were neutral in their relation to man, their larvae being for the most part scavengers in decaying vegetation. But as no beneficial Tachinid or Syrphid flies had been eaten, the role of the lizards as fly-catchers is interesting rather than important.

All the insects which lizards eat are not inimical to the interest of man. But altho some few are beneficial, and a considerable number are neutral, the injurious and destructive insects bulk so much the largest as to mark the lizards as being most beneficial and desirable allies of man.

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FIRST SUPPLEMENT TO INSECTAE PORTORICENSIS

Because the question has been asked, and to avoid further uncertainty, it should here be definitely stated that, unless otherwise specified, the descriptions appearing in *Insectae Portoricensis* of new species are by the compiler of the list, George N. Wolcott.

P. 16.

Dr. J. W. Folsom has given the MS. name of **Cremastocephalus bilobatus** to the green Collembola commonly found on canna, water hyacinth, *yautía,* corn and sugar cane, discussed by Wolcott 21–10.

P. 20.

For **Periplaneta australiae** Fabricius, read **Periplaneta australasiae** Fabricius.

P. 32.

Glyptotermes pubescens has been described by Dr. T. E. Snyder in No. 2496, Proc. U. S. National Museum, Vol. 64, Art. 6, pp. 1–40, pl. 1–5, 1924.

Nasutitermes (Tenuirostitermes) wolcotti has been described by Dr. Snyder in the Proceedings Entomological Society of Washington, Vol. 26, No. 5, May 1924, pp. 131–132.

P. 33.

For **Pseudocaecillus,** read **Pseudocaecilius.**

Mr. Rolla P. Currie has examined a small collection of Odonata from Porto Rico, and finds that the only species not recorded by Kolbe and Gundlach is **Scapanea frontalis** Burmeister.

He makes the following changes in the list of Odonata:

Erythragrion dominicanum Selys is now known as **Telebasis dominicana** Selys.

Erythragrion vulneratum Hagen is now known as **Telebasis vulnerata** Hagen.

For **Aeschinidae,** read **Aeschnidae.**

For **Gymnacantha,** read **Gynacantha.**

Libellula umbrata Linn. is now known as **Erythrodiplax umbrata** Linn.

Orthemis discolor Burmeister is now known as **Orthemis ferruginea** Fabricius.

Dythemis discreta Hagen (which should have been spelled **dicrota**) is now known as **Micrathyria didyma** Selys.

Diplax ambusta Hagen is now known as **Erythrodiplax connata justiniana** Selys.

Diplax portoricensis Kolbe (which should be **portoricana)** probably belongs in the genus **Erythrodiplax,** along with *minuscula.*

For *D. miniscula,* read *D. minuscula.*

Mr. Currie has also bracketed the names of most of the authors, showing generic transfers, but for consistency with the rest of the list, these are not here indicated.

P. 42.

Under **Odyneurus dejectus** Cresson, add

a large cluster on asparagus frond (224–23 det. Rohwer).

P. 43.

Under **Pseudagenia bella** Cresson, add

reared from mud nests on the leaves of *Inga vera* at Cayey (366–22 det. Rohwer).

Under **Crabro croesus** Lepeltier, add

reared from cocoons in rotten log (78–23 det. Rohwer); on Mona Island (1308–13).

P. 44.

Under **Notogonidea vinulenta** Cresson, add

on Mona Island (1310–13 det. Rohwer).

P. 60.

For the author of **Aspidiotiphagus citrinus,** instead of Crawford, read Craw; Dr. L. O. Howard states "it was Alexander Craw who described this species."

P. 65.

Add

Pimpla rufoniger Cresson — det. Cushman
at Aibonito (SSC).

P. 80.

For **Omalodes kugii** Marseul, read **Omalodes krugii** Marseul, add

Carnicops dominicana ? Marseul — det. A. J. Mutchler
under bark of *Erythrina* tree at Cayey (248–17).

P. 93.

Add

Stethorus punctum LeConte — det. Sicard (previously determined by Dr. Schwarz as "close to *punctum* Lec.")
on leaves of *Psidium guajava* and *Spondias lutea* (88–13, 722–16, 838–16).

P. 94.

After **Psyllobora lineolate** Fabricius, add

—confirmed by Dr. Sicard

and delete "presumably this species" on the next line.

P. 113.

For **Noda** sp. or **Nodonota** sp. — det. Cotton, read

Nodonota wolcotti Bryant, G. E., *in* "New Species of Phytophaga" Annals and Magazine of Natural History, Ser. 9, Vol. 13, p 299, March, 1924, TYPE from Porto Rico.

P. 116.

For **Homophoeta aequinoctailis** Fabricius, read

Homophoeta aequinoctialis Fabricius

P. 117.

Add

Hermaeophaga cubana Bryant, G. E., *in* Annals and Magazine of Natural History, Ser. 9, Vol. 13, p. 302, March, 1924, TYPE from Porto Rico.

millions on a few unidentified trees near Guayama (50–22).

P. 129.

After the last record under **Lachnopus coffeae montanus** Marshall, add

feeding on leaves of *Cestrum macrophyllum* Vent. (host determination by R. A. Toro) at Ciales (34–24).

P. 209.

Add

Root, Francis Metcalf, "Notes on Mosquitoes and other Blood-Sucking Flies from Porto Rico." *In* American Journal of Hygiene, Vol. 2, No. 4, July 1922, pp. 394–405, figs. 5.

Notes on the following species:

CHIRONOMIDÆ.

Culicoides furens Poey (Syn. **C. maculithorax** Williston)

SIMULIIDÆ.

Simulium quadrivittatum Loew

CULICIDÆ.

Anopheles albimanus Wiedemann

Anopheles grabhamii Theobald

Uranotaenia socialis Theobald

Uranotaenia lowii Theobald

Aedes (Stegomyia) aegypti Linnaeus

Aedes (Taeniorhynchus) portoricensis Ludlow

Aedes (Ochlerotatus) ? condolescens Dyar & Knab ? (larva described)

Psorophora jamaicensis Theobald

Culex (Culex) quinquefasciatus Say (Syn. **C. fatigans** Wied.)

Culex (Culex) nigripalpus Theobald, var. **similis** Theobald

Culex (Melanoconion) atratus Theobald (Syn. **C. falsificator** D. & K.)

Culex (Choeroporpa) borinqueni sp. nov. Root
"The commonest 'wild' *Culex* of the Porto Rican costal plain. . . . . found breeding in all sorts of slow streams, pools and marshy places, ... at Río Piedras, Martin Peña and Aguirre."

Deinocerites cancer Theobald

TABANIDÆ.

Chrysops costatus Fabricius — "mosca de manglar"

MUSCIDÆ.

Stomoxys calcitrans Linnaeus

P. 217.

For **Conicera aldrichii** Brues, read

Conicera latimana Malloch, J. R., "A New Species of **Conicera** from Porto Rico" *in* Proc. Ent. Soc. Washington, Vol. 26, No. 4, p. 73, April, 1924, TYPE from Porto Rico.
(as *Conicera aldrichii* Brues) Wetmore 16–74, eaten by hummingbird, *Anthrocothorax aurulentus*.

P. 222.

To the rearing records of **Nemorilla maculosa** Macquart, add

from *Tetralopha scabridella* Ragonot at Cayey (385–22 det. Aldrich).

About the middle of the page, add

Phorocera parviteres Aldrich — det. Aldrich
from *Pieris monuste* Linn. at Yauco (**77–23**); (sp.) from *Melanchroia cephise* Cramer (**6–24**).

P. 225.

The rearing records for **Sarcophaga robusta** Aldrich are incorrect for this species. It should read

Sarcophaga robusta Aldrich
Aldrich 16–268: from Mayagüez, P. R.

Sarcophaga sternodontis Townsend
Aldrich 16–267: from Mayagüez, P. R.
Jones & Wolcott 22–49: from pupae of *Mocis (Remigia) repanda* Fabr. and from white grubs.
(452–12, 766–12, ... etc.

P. 239.

Mr. A. C. Morgan of Clarksville, Tenn. has identified the following thrips (Thysanoptera) which are new to Porto Rico, and will describe the new genus and species in a forthcoming paper.

TEREBRANTIA.

Cercyothrips gen. et sp. nov.
collected by E. G. Smyth, October 7, 1919 at Río Piedras (685–19).

Limnothrips cerealium Haliday
on sugar-cane leaves at Guánica, March 18, 1920 (GNW).

Corynothrips stenopterus Williams
on "yuca", *Agava sissalana*, Nov. 18, 1919 at Río Piedras (788A–19).

Franklinothrips vespiformis Crawford
collected by E. G. Smyth at Río Piedras.

Heliothrips fasciatus Pergande
on alfalfa at Río Piedras, Nov. 16, 1923 (349–23), collected by F. Sein.

Anaphothrips sp. nov.
four females from leaves of sugar cane at Bayamón, May 5, 1920 (GNW).

Sericothrips sp. nov.
two females collected by E. G. Smyth at Río Piedras, March 25, 1920.

TUBULIFERA.

Ommatothrips gossypii Hood
on coffee leaves (GNW); on leaves of *Inga vera* at Cayey (306–23).

Gastrothrips sp. nov.
in stomach of lizard, *Anolis cristatellus* D. & B., Oct. 3, 1923 (308–23).

Diceratothrips sp. nov.
in rotten cotton boll injured by Pink Bollworm at Pt. Cangrejos (307–23); on leaves of *Inga vera* at Cayey (306–23).

Lissothrips subgen. et sp. nov.
from stomach of lizard, *Anolis stratulus* Cope, collected May 9, 1924, at Hacienda Santa Catalina, Mameyes by F. Seín.

Hindsiana cocois Watson
on leaves of sugar cane at Camuy, April 26, 1920 (GNW).

Hindsiana weigeli Watson
(probably from sugar cane) at Río Piedras, Feb. 23, 1920 (GNW).

P. 244.

For VELIDAE, read VELIIDAE.

P. 257.

For wild Bougainvillea vine, read *Trichostigma octandra* (L.) H. Walt (host determination by R. A. Toro).

P. 270.

Add

Cubana tortriciformis Muir MS sp. nov.
from el Yunque (29–24).

P. 281.

To the host records of **Pseudococcus bromeliae** Bouché. add

on aerial roots of "jagüey", *Ficus laevigata*, attended by "hormiguilla", at Manatí (24–24 det. Ferris).

Also add

Pseudococcus comstocki Kuwana — det. Ferris
from stomach of lizard, *Anolis pulchellus* D. & B., at Toa Baja (lizard No. 306).

P. 291.

Add a host record for **Pseudoparlatoria ostreata** Cockerell,

on *Piper medium* stems from Manatí (25–24 det. Ferris).

P. 306.

Add

Opogona 206

o-O-o